## Perivascular cells for regenerative medicine.

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**Public Summary:**
Mesenchymal stem/stromal cells (MSC) are currently the best candidate therapeutic cells for regenerative medicine related to osteoarticular, muscular, vascular and inflammatory diseases, although these cells remain heterogeneous and necessitate a better biological characterization. We and others recently described that MSC originate from two types of perivascular cells, namely pericytes and adventitial cells and contain the in situ counterpart of MSC in developing and adult human organs, which can be prospectively purified using well defined cell surface markers. Pericytes encircle endothelial cells of capillaries and microvessels and express the adhesion molecule CD146 and the PDGFRβ, but lack endothelial and haematopoietic markers such as CD34, CD31, vWF (von Willebrand factor), the ligand for Ulex europaeus 1 (UEA1) and CD45 respectively. The proteoglycan NG2 is a pericyte marker exclusively associated with the arterial system. Besides its expression in smooth muscle cells, smooth muscle actin (αSMA) is also detected in subsets of pericytes. Adventitial cells surround the largest vessels and, opposite to pericytes, are not closely associated to endothelial cells. Adventitial cells express CD34 and lack αSMA and all endothelial and haematopoietic cell markers, as for pericytes. Altogether, pericytes and adventitial perivascular cells express in situ and in culture markers of MSC and display capacities to differentiate towards osteogenic, adipogenic and chondrogenic cell lineages. Importantly, adventitial cells can differentiate into pericyte-like cells under inductive conditions in vitro. Altogether, using purified perivascular cells instead of MSC may bring higher benefits to regenerative medicine, including the possibility, for the first time, to use these cells uncultured.

**Scientific Abstract:**
Mesenchymal stem/stromal cells (MSC) are currently the best candidate therapeutic cells for regenerative medicine related to osteoarticular, muscular, vascular and inflammatory diseases, although these cells remain heterogeneous and necessitate a better biologic characterization. We and others recently described that MSC originate from two types of perivascular cells, namely pericytes and adventitial cells and contain the in situ counterpart of MSC in developing and adult human organs, which can be prospectively purified using well defined cell surface markers. Pericytes encircle endothelial cells of capillaries and microvessels and express the adhesion molecule CD146 and the PDGFRbeta, but lack endothelial and hematopoietic markers such as CD34, CD31, vWF (von Willebrand factor), the ligand for Ulex europaeus 1 (UEA1) and CD45 respectively. The proteoglycan NG2 is a pericyte marker exclusively associated with the arterial system. Beside its expression in smooth muscle cells, smooth muscle actin (alphaSMA) is also detected in subsets of pericytes. Adventitial cells surround the largest vessels and, opposite to pericytes, are not closely associated to endothelial cells. Adventitial cells express CD34 and lack alphaSMA and all endothelial and hematopoietic cell markers, as for pericytes. Altogether, pericytes and adventitial perivascular cells express in situ and in culture markers of MSC and display capacities to differentiate toward osteogenic, adipogenic and chondrogenic cell lineages. Importantly, adventitial cells can differentiate into pericyte-like cells under inductive conditions in vitro. Altogether, using purified perivascular cells instead of MSC may bring higher benefits to regenerative medicine, including the possibility, for the first time, to use these cells uncultured. (c) 2012 The Authors Journal of Cellular and Molecular Medicine (c) 2012 Foundation for Cellular and Molecular Medicine/Blackwell Publishing Ltd.